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ENERGY CONSERVATION

USE OF THERMAL WATERS IN KRASNODARSKIY KRAY LAUDED

Moscow PRAVDA in Russian 8 Dec 81 p 2

[Article by S. Medunov, first secretary of the Krasnodar CPSU kraykom: "By Integrated Programs"]

> [Excerpts] The motto of "The Economy Must Be Economical" that was advanced at the 26th CPSU Congress has received national support. The collectives of the enterprises, construction sites, kolkhozes and sovkhozes have universally made plans for a prudent consumption of materials, raw materials, fuel and electricity, and efficient use of each national ruble.

The introduction of an integrated program at Kuban' to improve the efficient use of fuel and energy resources is very promising. It was recently approved by the office of the CPSU kraykom and the krayispolkom. It plans ways for better use of the local resources. It is planned, in particular, to conserve 820 million kW-h of electricity, over 1 million Gcal of heat, and about 700,000 T of fuel during the five-year plan. This will be a weighty contribution of the people of Kuban' to the national struggle for conservation and economy.

The kray is also focusing attention on thermal waters. This is a solid potential source of additional energy. They are widespread on 65 percent of the kray. Their total geological reserves are assessed at 1.5 trillion m^3. In an energy respect this means 18 billion T of conventional fuel.

Our conclusions here are also based on practice. About 80 wells are currently operating in the kray. They annually provide over 12 million m^3 of water with a temperature of 70-75°. In the Mostovskiy, Labinskiy Rayons, the Maykopskiy Rayon of the Adygeyskaya Autonomous Oblast, they heat 28 hectares of coated and winter greenhouses. In the last five-year plan alone, 6,300 T of vegetables were grown in these greenhouses of the intereconomic association "Plodoovoshchevod" of the Mostovskiy Rayon. The farm received over R 5 million of profit.

Thermal waters can noticeably increase the efficiency of pond pisciculture. The progeny of all species of fish can be obtained a month earlier. This means that we will grow more major fish-hatching material. It has been computed that in the Krasnodarskiy Kray there is a real possibility of increasing fish productivity of fattening reservoirs by 15-20 percent. Without any expenditures, about an additional 40,000 quintals of high quality commercial fish can be obtained.

In a word, there are enormous potentialities for using the heat of the depths of the earth. It is being used even today to heat animal husbandry buildings, housing and cultural-general facilities, as hot water supply, and also in the construction industry. We plan to bring the extraction of thermal waters in the 11th Five-Year Plan to 22 million m^3, and expand the range of their application even more. The areas of greenhouses heated by them will rise to 300 hectares.

It consequently appears that the time has come to create a unified scientific and production association in our kray that would do the planning operations, conduct extraction and utilize the thermal waters.

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ENERGY CONSERVATION

OIL PRODUCT RECYCLING ENCOURAGED

Moscow PRAVDA in Russian 10 Dec 81 p 3

[Article by M. Bogdanov, head of the section of the Ukrainian SSR Committee of People's Control: "Oil Sources Occur in the Shops"]

> [Text] There is perhaps no machine or vehicle that could operate normally without lubrication. It has to be changed from time to time. What happens to the used oil? The so-called secondary oil products?
>
> It happens that they are thrown out. But the experience of many enterprises indicates that the used oil can and should be collected, restored and regenerated.

The Kiev Plant of Automatic Machines imeni Gor'kiy, for example, collected and purified 111 T of used oil last year and is re-using them for its production needs. This results in a 40-45 percent reduction in the need for fresh lubricants. The Kiev river port produced 1,400 T of secondary oil products during the year. This provided it with over R 50,000 of profit. The Chernigov rayon association "Sel'khoztekhnika" equipped a special truck that constantly collects the used oils in all the kolkhozes and sovkhozes and hauls them to the reception station.

Just how advantageous this is is apparent from the fact that regeneration of each ton of oil yields 700-800 kg of pure oils whose generation usually requires almost 5 T of oil. This means that the Kiev machine builders, after collecting 111 T of wastes, at the same time "extracted" about 555 T in their shops, and the port workers returned almost 7,000 T of oil to the country!

The checks made by the agencies of people's control, however, indicate that considerable losses of valuable raw material are still permitted in many places. The assignments for its collection are constantly foiled at the enterprises of the coal, food, electrical engineering industries, heavy machine construction and construction materials. This work has been set up extremely poorly in the majority of construction organizations, kolkhozes and sovkhozes.

It is common knowledge that there are two categories of oils: industrial and motor. The first is used to lubricate machines, turbines and other units. This oil is purified for re-use usually at the actual enterprises. The second type is designed for internal combustion engines. It is regenerated in special units

at enterprises of the Ministry of Petroleum Refining and Petrochemical Industry. It goes without saying that both have to be collected separately, for they are not purified when in a mixture. At the same time, everything occurs in one boiler at many enterprises.

Clear poor management has been allowed at the Enakiyevo Metallurgical Plant. In the last 1.5 years it has lost 840 T of used lubricants. They were poured out wherever they dropped. The enterprise does have everything needed to collect and purify the secondary raw material, the tanks and the units.

Poor management was also permitted at the Darnitskiy Repair Plant of the UkSSR State Committee of Agricultural Equipment. The standards of oil consumption were not reviewed here for a long time and were overestimated by more than 1.5-fold. No accounting was set up for the collection and handing over of used substances, and large losses of them were allowed. The committee punished the leaders of these plants.

There is more. Now only about one-third of the collected oil that is suitable for restoration is purified in the republic. Only one out of every five enterprises that consumes over 50 T of industrial oils per year has a unit to regenerate them. They should be at every one. The Ministries of Ferrous Metallurgy, Agricultural Machine Construction, Machine Construction and certain others unfortunately have not expanded the network of these units at their enterprises. Their construction is not even stipulated at the major plants under construction: Lutsk Bearing Plant, Sumy Rubber Engineering Items Plant, L'vov Electrical Engineering Plant (production association "Iskra").

Other managers cite the shortage of equipment for regeneration when the topic turns to secondary oil products. They are correct to a certain measure. The association "Vtornefteprodukt" which is subordinate to the RSFSR State Committee of Petroleum Products has been about to start construction of a plant for manufacture of regeneration equipment for several years now, but as of yet the plant is still on the drawing board.

However, even the available units at many enterprises are only half utilized, and some are inactive. Thus, equipment was installed long ago at the Nezhinsk Mechanical Plant of the association "Soyuzprodmash" to regenerate industrial oils, but they are burned as fuel in the boiler house. Two units have been lying for over 6 years in the warehouses of the Krimsk Soda Plant. If they were put into operation, the used oil could be purified not only from this enterprise, but also the three plants of the same Ministry of the Chemical Industry that are located nearby. But no one has done anything as yet.

By the way, the potentialities for cooperation are not only present in the Crimea. In the Rovenskaya Oblast, say, two dozen enterprises must purify industrial oils, but none of them has the necessary equipment. At the same time, all the secondary oil products collected by them, over 800 T per year, could be successfully purified in the regeneration shop of the Rovno production association "Azot," where the units are only one-fifth loaded. Interdepartmental barriers are inhibiting the matter.

Industrial regeneration of used motor oils must be set up by the Ministry of Petroleum Refining and the Petrochemical Industry at plants under its jurisdiction. But again there are not enough facilities. The construction of a large unit for this purpose at the Kremenchug Oil Refinery has not even begun, although it was planned to start it up back in the last five-year plan. This is how it happened that the used industrial and motor oils that are collected in groups and for which high prices were paid to the dealers are often discarded to commercial-grade oil and redistilled, mainly into mazut at the oil refineries.

Now when the base for restoration of the used substances is far from completely ready, it is apparently expedient for the USSR State Committee of Petroleum Products to review the question of using some part of them for technological and fuel needs.

It is also no secret that poor management is sometimes the cause of the use of expensive fresh oil where it is quite possible to utilize used oil. Here is a typical example. Last year the Priluki plant of construction materials spent 40 T of industrial oil for pouring into the reducers of slow-speed cars in which adobe is fed into the furnace for roasting. Each time all the expensive oil is burned up there. It appears that secondary oil products, and not fresh should be allocated for these needs.

There are still problems with the shipping of used lubricants. Often the oil collecting agencies to please themselves force the enterprises to make unjustified shipments. The production association "Makeyevugol'," a large consumer of oil, thus has its own tanks for the collection and storage of used petroleum products, spur-tracks and can send the raw material directly to the refinery. But it is forced to haul by truck the used oil to a bulk plant which is located considerably further. It is then shipped from the bulk plant by railroad tank cars to the plant. The Donetsk bulk plant thus artificially increases the commodity turnover.

The requirement to wisely and economically deal with all resources resounded at the November Plenum of the CPSU Central Committee with new force. By involving secondary petroleum products in the economic turnover, we can save a lot of expensive lubricants for which the demand is constantly rising.

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ENERGY CONSERVATION

ARCHITECTURAL DESIGNS BLAMED FOR HEAT LOSSES

Moscow IZVESTIYA in Russian 10 Dec 81 p 2

[Article by L. Boguslavskiy and R. Merkin, professors, doctors of economics: "Heat to the Wind?"]

[Text] IZVESTIYA (No 286, 1977) published the letter "Why Heat the Street?" 4 years ago. It stated that the architects , designers and builders were not sufficiently concerned about heat conservation. An excessively large area of glass in buildings, their complicated configuration and enlargement of the loggias resulted in a diminished level of heat protection of the buildings. This level was also diminished because the norms that were active at that time did not stipulate for less heat-conducting designs of windows with triple glazing for residential buildings and other buildings in a number of regions of the country. The letter also spoke of panel walls whose heat protection is 10-20 percent lower than the permissible level. The letter stressed our lagging behind many countries in the use of triple-layer wall panels that reduce heat losses 3-5-fold as compared to single-layer claydite concrete panels.

After examining the newspaper account, the USSR Council of Ministers planned a number of emergency measures to strengthe the thermal protection of buildings. They included: change of construction norms and rules, reduction in the volume of use of single-layer glazing in production buildings, improvement in the heat-insulating characteristics of the wall panels, forbidding the development of building projects with above-standard areas of glazing, expansion of the area of mandatory use of filling of the light passages of three-layer glazing.

What has been done in the past 4 years? How have these decisions been implemented that were subsequently fixed as standards by the USSR Gosstroy?

The designing of buildings with excessively large panes and complex configuration has not yet been successfully halted. The USSR Gosstroy last year had to again approach all the ministries and departments of the country to halt excess in glazing buildings.

There recently was an exhibition of the best architectural designs of buildings of varying purpose in connection with the seventh congress of architects in Moscow. How much excess in windows and configuration was propagandized there! Take, for example, the engineering framework of the Georgian SSR Ministry of Automobile Roads. The authors designed it in the form of a "tree" with numerous horizontally

arranged "branches" at different heights which hold the service rooms. Roughly 3 times more heat is used to heat this building than for a building of similar purpose of normal configuration. The outlays for its erection and operation were exorbitantly high. Is there any sense in advertising such wasteful architectural "masterpieces?"

Definite steps have been taken in relation to the triple-layer glazing of windows. The area of their mandatory application has significantly expanded. But in fact it is still almost not used. The main reasons are that the manufacture of triple-layer window frames requires an annual additional over 300,000 m^3 of high-quality scarce lumber, the labor-intensity of the items is increased, and correspondingly, the output of the wood working plants is reduced.

It is necessary to improve the design of the windows, to make them lighter, less expensive and less labor-intensive. It has not yet been possible to achieve this by improving the traditional designs. The recently approved standard for windows with three-layer glazing was only close in lumber consumption to the standard that was developed in Finland over 40 years ago! The windows that were recently made in the form of "glass packets" proved to be excessively expensive.

But 10 years ago the State Committee of Civil Construction approved an original design for window units with three layers of glass in one casement which guarantees a considerable reduction in the consumption of lumber and labor expenditures at the plant. This design has passed comprehensive heat engineering and light engineering tests in four scientific research institutes. But 10 years have already passed, and the promising design still remains on paper.

The interesting experience of the GDR is also not being used. Here glued instead of window casements with upper opening transom are used in buildings with loggias and rooms with balconies. Two-fold less lumber is used to make them than for our paired casements.

Triple-layer glazing of windows in the already operating buildings can be done without replacing the existing window units, by using an additional light hinged casement whose design was developed by the Academy of Communal Services jointly with the Moscow Engineering and Construction Institute. The RSFSR Ministry of Residential and Communal Services needs to begin broader and quicker introduction of this design into the cold regions of our country.

A unified technique has been created for determining the optimal level of heat protection of buildings. Its basic premises have been introduced into the construction standards, and then developed in the form of a special reference book. But there are so many dangerous errors here! In order to determine the thickness of the claydite concrete panels, it is recommended that their two-fold lower density be used than the current existing, with a corresponding decrease in the wall thickness. Not a single plant in the country manufactures these light panels, and will not be able to in the near future. Consequently, the mentioned "recommendation" inevitably results in a drastic increase in the consumption of heat. The standards also give an economic evaluation of the expediency of single-layer glazing in the houses in the Moscow region, a version which is completely impermissible.

The adopted solution to the question of increasing the heat protection qualities of the claydite concrete panels is not very understandable. This requirement has formally been fulfilled, but it is dictated by a 25-30 percent decrease in the thickness of the wall panels. It is suggested that this result be attained by using less heat conducting materials. However, this requires partial change of the technology for panel production. On a nationwide scale this is only feasible in the space of many years, and thinning of the walls has already begun. In the current five-year plan, consequently, a number of regions in the country will significantly increase the number of public buildings with increased heat consumption for heating.

The question of increasing consumption of effective heaters in the walls has been incorrectly resolved, in our opinion. They are currently very scarce, and therefore their additional consumption for heating the walls must be thoroughly substantiated. However, the USSR Gosstroy has decided to increase this consumption equally in all regions of the country by 50 or 100 percent. The economic effect of this measure depends primarily on the cost of the heat and the duration of the heating period.

Why do these not at all justifiable solutions arise? Obviously no consideration is given to the fact that conservation of heat must not be the goal in itself. Any such measure must be economically substantiated. Without this substantiation, only a demonstration of participation in the most important matter, conservation of energy can occur. But these demonstrations very often result in great losses for the national economy and do not decrease, but rather increase the consumption of heat!

What, in our viewpoint, should be done in the first place to conserve heat by reducing heat loss in the buildings?

First of all, strict control should be set up over the realization of already adopted decisions, and houses that do not meet the requirements for efficient heat protection should not be accepted for operation.

Secondly, plans that do not make the necessary changes following from the new design standards should be rejected.

The appropriate sections of the ispolkoms of the local soviets and leaders of the construction organizations, as well as directors of the enterprises for the production of carpentry items should immediately develop and present to the Gosstroys of the union republics, schedules for transition to three-layer glazing in those regions where this has been acknowledged to be economically expedient.

The agencies of the USSR Stroybank have unfortunately adopted a neutral position in this matter until now. They now have the necessary authority to deny credit to those designs that do not meet the standard requirements for heat protection.

It is finally impossible to abandon the economic levers of fuel conservation from consideration.

The set of thoroughly thought out and balanced measures which can be systematically controlled by the USSR Gosstroy and the USSR Stroybank and which are aimed at improving the heat protection of buildings will be a specific response to the words of comrade L. I. Brezhnev from a speech at the November (1981) Plenum of the CPSU Central Committee on the need to use all the available levers and stimuli for conservation of fuel and energy.

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ENERGY CONSERVATION

FUEL WASTE VIOLATIONS REVEALED

Alma-Ata KAZAKHSTANSKAYA PRAVDA in Russian 1 Dec 81 p 3

[Article: "Economical Consumption of Petroleum Products"]

[Text] The republic's committee of people's control discussed the results of a check of the preservation of socialist property, correct accounting and distribution of petroleum products in the organizations of the Kazakh SSR State Committee of Petroleum Products. The check established that individual petroleum marketing organizations of the republic's State Committee of Pet eum Products are allowing serious shortcomings in fulfillment of the party and g nment instructions to strengthen the preservation of socialist property. Numerous cases of violation of the operational and bookkeeping accounting for movement and the order of distribution of petroleum products have been established at the bulk plants and filling stations of the Kzyl-Ordinskaya, Taldy-Kurganskaya, Dzhambulskaya, Alma-Atinskaya Oblasts and a number of others.

The committee noted that the low level of leadership and insufficient monitoring are the main reasons for the excesses and shortages of fuels and lubricants at the bulk plants and the filling stations of the Kzyl-Orda administration of the State Committee of Petroleum Products, for allowed illegal accumulation and appropriation of coupons, and the nonfulfillment of plans for realization of the market fund and collection of spent petroleum products. The majority of bulk plants do not monitor the quality of the fuels and lubricants. The workers of the Kazakh SSR Ministry of Internal Affairs have revealed facts of fuel and lubricant misappropriation at the oblast filling stations, including the Kzyl-Orda, Chiili, and Chiganak.

Violations in the accounting and observance of the set rules for distribution and storage of petroleum products have been established at the bulk plants and filling stations of the Taldy-Kurgan administration of the State Committee of Petroleum Products. Major shortages of different petroleum products have been found at the checked bulk plants and filling stations of the oblast. A large number of shortages and excesses of fuels and lubricants have been found at the Taldy-Kurgan bulk plants,as well as the Karabulak, Saryozek, Tekeli and other filling stations. This was a consequence of neglected accounting, low level of metrological maintenance of the counting mechanisms of the fuel pumps and weak executive discipline of the bulk plant and filling station workers.

Over 2,000 T of petroleum products flowed from faulty tanks and product pipelines at the Dznambul bulk plant in 1980-1981. The lack of discipline and carelessness of the workers of this same bulk plant caused spillage of 142 T of gasoline in May. The loss was R 97,000.

Proper measures are not being taken to guarantee preservation of socialist property at the Alma-Ata specialized bulk plant. The attendants of the filling station at this bulk plant misappropriate a lot of fuels and lubricants by selling the state gasoline for cash to private car owners. The quantity of fuel sold is covered by single state coupons that are accumulated illegally.

Misappropriation of petroleum products, shortages and surpluses of fuels and lubricants and other misuses at the filling stations of the Alma-Ata special bulk plant continue to occur even now. The plant management has allowed liberalism towards the filling station workers who have compromised themselves.

The committee focused the attention of the chairman of the Kazakh SSR State Committee of Petroleum Products, A. K. Bragin, to the presence of serious shortcomings in the preservation of socialist property, violations of the established order for accounting and distributing fuels and lubricants at the enterprises under its jurisdiction. Consideration was made for his announcement that measures are being taken to strengthen work aimed at observing the preservation of socialist property at the bulk plants and the filling stations of the republic and eliminating the existing violations of the accounting and distribution of petroleum products.

The director of the Dzhambul bulk plant, S. B. Baynazarov, was fired for poor management, permitted losses of fuels and lubricants and the damage caused. The documents were sent to the investigation agencies to institute criminal proceedings.

The chief engineer of the Kzyl-Orda administration of the State Committee of Petroleum Products A. B. Aboreyev was reprimanded for serious shortcomings and violations in the accounting and distribution of petroleum products, and existing mismanagement at the bulk plants and the filling stations of the oblast.

The head of the Taldy-Kurgan administration of the State Committee of Petroleum Products, T. B. Naumov, was reprimanded for the lack of proper exactingness towards the leaders of the bulk plants and filling stations under his jurisdiction, as well as for violations allowed in the accounting and distribution of petroleum products.

The committee fired the director of the Alma-Ata specialized bulk plant N. S. Bashkatkin for low level of leadership, lack of guarantee of the preservation of socialist property and for not taking the proper measures against the individuals who permitted misuse and misappropriation of petroleum products.

ROTATING WORKERS AT NORTHERN OILFIELD COMPLAIN ABOUT AIR SERVICE

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 13 Dec 81 p 2

[Article by V. Aleshechkin, operator of the PRS Department of the Order of Lenin NGDU [Oil and Gas Recovery Administration] of Nizhnevartovskneft': "Rotating-Duty Personnel and Obstacles"]

[Text] In the article, "A Dance in an Airplane at 35 Degrees Below Zero," SOTSIALISTICHESKAYA INDUSTRIYA told about the hardships of oilfield workers of the Tyumen' North caused by Aeroflot's imprecise work. "The attitude in airports of the North toward aircraft that haul rotating-duty personnel--drillers, oilfield workers and builders--leaves much to be desired. It should not be forgotten that these are not ordinary flights. The people are tired from a strenuous work regime of 15 days, during which they have carried out the norms for a month. Therefore, everyone who serves these flights should be very attentive and have a well-disposed attitude. It so happens that the most difficult part of the rotating personnel's work is at airports." This is what Tatneftegazrazvedka [Tatar Trust for Oil and Gas Exploration] chief mechanic A. Naberezhnov and chief trust engineer G. Sitnikov wrote in their letter, which was published on 5 May, this year. SOTSIALISTICHESKAYA INDUSTRIYA soon received and published the Ministry of Civil Aviation answer, which reported that steps had been taken and the guilty punished. Half a year has passed, and here is a new and disturbing letter. In publishing it, the editorial board is counting on the interested ministries' being actually concerned about the needs of rotating-duty personnel and about resolving finally a question that is so urgent for them, without restricting themselves to partial measures.

On this occasion we flew from Nizhnevartovsk to Bugul'ma, through Chelyabinsk. When the airplane had landed and the rotating personnel had deplaned, the first thing that struck the eye was a slogan that stretched along the front of the Chelyabinsk air terminal building: "Aeroflot should be a model for transport." Should be, but for now....

A recent incident is recalled. Our group of oilfield workers should fly to work on the 2d of each month at 2200 hours. On 2 October we were seated at the Bugul'ma

airport building prior to 2200 hours. Suddenly an announcement was made: you will fly tomorrow at 1100 hours. We left to spend the night at home. The next morning we again went to the airport. At 1100 hours an announcer's voice impassively muttered: "The special flight for oilfield workers of the NGDU of Nizhnevartovskneft' is delayed until 1300 hours because the airplane has not arrived." It should have arrived from Ul'yanovsk. We sit and wait, with no problem. At the appointed time the voice said: "The flight is postponed until 1500 hours." The reason is the same. Again we sit. Then the flight has been changed to 1700 hours, but even at 1700 hours nothing happens. First the weather was at fault, although the sky above us was of primordial purity. Then there were technical reasons. Finally they gave us the flight. The flight lasted 40 minutes and we were in Ufa. At Ufa we sat for an hour and a half, awaiting refueling. We flew into Khanty-Mansiysk towards morning. The airport greeted us with silence and calm. We sat for exactly 2½ hours (the plane's side number was 87944, the flight number was 29546, and the crew was from the Ul'yanovsk Aviation Enterprise). The servicing group was stirred into action without difficulty, they refueled us, and after an hour's flight we were--finally--in Nizhnevartovsk. The flight, which ordinarily takes about 5 hours, had lasted almost a day.

And so we managed to get to work. However, on the way home it turned out that we found ourselves occasionally in a still more complicated situation. Out of the 19 persons of our association who were waiting for the 22 July flight from Nizhnevartovsk, only 7 remained--the rest, without enduring the experience of waiting, had flown home by roundabout routes at their own expense. And this is not surprising--for the flight was delayed for...2½ days. It was still summer when the Ministry of Civil Aviation, judging by the answer to the criticism that had been published in the newspaper, had at once taken measures to improve service for rotating-duty personnel. But today the situation is improved hardly at all.

Hoist operator Yevgeniy Sukhovatkin, who has been working at Samotlor for 4 years, told me:

"It would be nice to work if it were not for this air terminal reshuffling. But the fact that there is no flight leads to nervous strain. If they want to--they will give you an airplane, if they don't want to, you'll sit...."

Actually, the arrival at Nizhnevartovsk of aircraft for rotating-duty personnel precisely on time has become such a rarity that when, on 18 October, the Bugul'ma airplane landed only 1½ hours late, this was considered miraculous.

However, it can and does happen that one can fly to work for nothing. At the end of last year the deputy chief of the NGDU of Nizhnevartovskneft', V. Sultanov, flew to Tataria in order to conclude an agreement with the local aviators for 1981. The Bugul'ma people refused at once: they had so many customers. Naberezhnyye Chelny also refused. Efforts were made to conclude agreements with Ufa and Kuybyshev--but uselessly. It is good that the Volga Civil Aviation Administration advised that he get in touch with Ul'yanovsk. There they made an agreement. But, perhaps, only until the new year, 1982?

And there is still another question that disturbs, certainly, many: the provisioning of local motor-vehicle transport. Prior to 1981, in Leninogorsk for example, rotating-duty personnel who worked in the Komi ASSR and West Siberia were allocated buses. This year the Tatar Motor-Vehicle Transport Trust management put an end to

this, it being, apparently, too generous an undertaking. At night now, in Bugul'ma an empty parking lot awaits rotating-duty workers at the airport, or, in the best case, there are some moonlighters with personal cars.

In the Nizhnevartovskneftegaz Association more than 4,500 people are working under the rotating-expeditionary method, and flights are being made from 75 cities of the country. Losses of worktime and, naturally, of oil, are very great, because of delayed takeoffs of aircraft and delays thereof en route. Therefore it was decided to reduce systematically manning of that category of rotating-duty personnel who are not covered by organized hauling.

The laboring collectives of Tyumenskaya Oblast were included in the socialist competition to recover 1 million tons of oil and 1 billion cubic meters of gas monthly. The party's Central Committee approved and highly evaluated this initiative. A task of enormous state importance has been set. But how well we carry it out depends upon the solution of transportation problems.

11409
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PROBLEMS, PROGRESS AT MANGYSHLAK OILFIELD CITED

Alma-Ata KAZAKHSTANSKAYA PRAVDA in Russian 15 Nov 81 p 2

[Article by A. Malinovskiy (Mangyshlakskaya Oblast): "Mangyshlak Greetings"; passages enclosed in slantlines printed in boldface]

> [Excerpts] We read in the Kazakhstan Communist Party Central Committee decree, "On the 250th Anniversary of the Voluntary Annexation of Kazakhstan to Russia":
>
> "The economic, scientific and technical ties of Kazakhstan with the fraternal republics are being deepened increasingly, and Kazakhstan's importance in socialist cooperation and the division of labor within the united national economic complex of the USSR is growing. With the assistance of the RSFSR and other Union republics, such mighty territorial production complexes as those of Pavlodar-Ekibastuz, Karatau-Dzhambul and Mangyshlak have been established and are being developed at an accelerated pace...."
>
> Mangyshlak....For centuries it remained a severe lifeless wilderness. One could travel hundreds of kilometers and not encounter life. Soviet power and the fraternal assistance of the Russian and other peoples of our country have enabled the face of the peninsula of treasures to be radically changed. Nowadays Mangyshlakskaya Oblast workers are making an increasingly meaningful contribution to the development of the socialist motherland's economy. The socialist competition in honor of the 60th anniversary of the establishment of the USSR is acquiring an ever greater sweep.

Since the beginning of the development of Uzen' oilfields, more than 160 million tons of crude have been recovered. The collective has started the 11th Five-Year Plan well. Oilfield support workers are actively upholding the initiative of the Tyumen' oilfield workers, who called for the promoting of socialist competition to fulfill plans ahead of time. The commitment this year is to recover 99,700 tons of crude above the goal and to produce it with high quality.

The commitments that have been adopted are being carried out successfully. More than 80,000 tons of crude and hundreds of thousands of cubic meters of gas have been recovered above the plan.

Nature concealed its riches securely in Mangyshlak's ground. It is not easy to get them. And in this regard, the Uzen' oil-bearing region--a promising one for the oblast--has been and is being developed as a unique springboard, at which both the strategy and the tactics of the offensive on the virgin oil lands are being worked out.

Chief of the NGDU [Oil and Gas Recovery Administration] of Uzen'neft' Association Makhombet Demeshevich Batyrbekov--an experienced oilfield-worker specialist--can talk about this for a long time and with deep inspiration.

Integrated automation has been accomplished at the oilfield's support facilities, and the intensive technology of recovering oil, particularly gaslift technology, is being introduced. Suffice it to say that the flow of gaslift wells is growing severalfold.

And here is another technical innovation. Hydraulic pumping jacks, to which the oilfield workers have responded with delight, have been installed at 75 wells.

/We observed one such hydraulic pumping jack at work. The short metal column rhythmically gave off sounds reminiscent of inhalation and exhalation. It seemed as if it took oil from the depths without any special effort, sending it to the tanks over pipes buried in the ground. And not far away, like a gigantic pump handle, descending and rising, an older type pumping jack was operating. Its biography spanned a hundred years.

"The tests are going on successfully," explains the NGDU chief. "The hydraulic pumping jack is distinguished by low metals intensiveness--no more than 800 kilograms, while the weight of an ordinary one is from 14 to 16 tons. Servicing has been facilitated by far. It is easy to assemble or disassemble one of these pumping jacks. We intend to create a special section."

"What advantages does its wide use promise?"

"The main thing is that labor productivity and profitability in recovering oil are raised."

A young woman approached in neat coveralls. Her facial features reminded one of the remarkable portrait, "Kazashki Kati," which was painted by Taras Shevchenko during a visit to Mangyshlak.

Akzhan Kadimova had come to Novyy Uzen' after completion of the Dossor Vocational and Technical School. She passed the good vocational and labor school of the experienced oilfield workers, and, with her persistence and devotion to the job, had won deserved authority. Testifying to this is the Order of Labor Glory, 3d Degree, which marked her successes. Right now she is working in a brigade as a senior operator.

"Ask any of our workers," says Akzhan, "what the main thing consists of. And he, I am confident, will answer: to consolidate the results achieved, to stabilize the level of oil recovery and to achieve new and still higher results."

Akzhan Kadimova touched upon many problems of a production and socio-economic nature during our conversation.

"It is disquieting," she said, "that oilfield workers at times let their partners down. They have talked so many times about a reliable power supply for the oilfields, but the situation is not being improved...."

Yes, Akzhan touched a sore spot. Interruptions in the power supply will undermine production at any enterprise, but it tells especially painfully in the work of oilfield support facilities. We ourselves had become unwilling witnesses of a complicated situation that arises at the oilfield's support facilities: the day before, the delivery of electricity had been curtailed. As was explained to us, such situations are paid for with thousands of tons of oil that are not pumped out of the ground. The wells act is if they had been affected by a grave illness, and, in order to introduce them to the normal operating regime, much expensive time is required.

/You hear Akzhan's disturbing words and you are permeated by her concern for the overall job and for the prestige and stature of her native Mangyshlak. And at the same time you involuntarily think, what a vast gulf has separated the fate of prerevolutionary and Soviet Kazakh women. Colorful legends of the past have painted an unassailable beauty, but in reality life was a meek existence. The model of the women of the prerevolutionary Central Asian village, who milked the mares, rolled the felt, raised the sons and were left without rights all their life, lives in memory.

In our day, legends are being born about such women as Akzhan Kaimova and her companions in labor./

A broad industrial experiment on multistage thermal water flooding is being urgently conducted at the Uzen' oilfields. Special installations have been erected here for preparing and pumping hot water into the oil-bearing formations. Kadzhi Mazayevich Ramazanov works as the chief of one of these installations. Six furnaces joined into three units produce 150 m^3 of hot water per hour each.

"This method has already proved its effectiveness," says K. M. Ramazanov. "Only here is the harm: we are experiencing, if one can call it that, a constant hunger for water."

A shortage of water! We had heard about that before we came to the oilfield support facilities. Each day up to 150,000 m^3 of water must be pumped into the Uzen' formations. Part of it is obtained from underground sources, but the bulk of it comes from the Caspian. The sole waterline often goes out of order. Life itself dictates the necessity for laying a new strand of waterline.

There is a remarkable lack of balance not only with regard to industrial water. Great hopes have been placed on the Amudar'ya-Novyy Uzen' waterline. The water has numerous proprietors en route from Uzbekistan to the water terminal. As a result, water does not arrive for the oilfield workers in the planned amounts.

/Novyy Uzen' is unique, even for Mangyshlak's conditions. It includes land occupied by the oilfield facilities, a gas-treatment plant and other industrial enterprises. The facilities have been strewn about the steppe, separated from each other by great distances. But the city remains a city, and the tasks that face the city's party committee and the soviet of people's deputies are extraordinarily complicated./

Nurlykhan Uteuovich has committed many figures to memory. The city's housing inventory is growing continuously. Special concern is displayed about the growing population. A new, the seventh, intermediate school is being turned over. Many lads are engaged in music and sports schools. An interbranch production-training combine at which the students master workers' trades is in operation in the city. The first graduation has been held.

It has been said correctly that it is better to see something once than to hear it 100 times. We visited the new Pioneers' Palace--an excellent building that would embellish any oblast center. Director Nadezhda Grigor'yevna Sayfullina spoke in detail about the work of the various societies--there are more than 20.

And not far away, sparkling in the sun with bright colors, towers the Oilfield Workers' Palace, which was built by the 60th anniversary of the Kazakh SSR. There is a rich technical library, a reading hall, a room for activities by adults and children--in brief, all the prerequisites for sophisticated recreation are at the disposal of workers and their families. Enthusiasts have undertaken to organize a museum that will reflect the kray's prerevolutionary history, and also its blossoming during the years of Soviet power and the heroic labor of the people who brought this severe land to life.

An agrarian department for farm workers is taking its first steps. A hothouse 12,000 m^2 in area is in operation. Naturally, its products go primarily to children and medical institutions. But the possibilities for expanding the hothouse activity are extremely great, and they should be used more completely. This year 10 hectares were allocated for melon fields, from which 60 tons of watermelons were gathered.

"We have accomplished much already," says the party gorkom secretary, "to improve cultural and amenities services for the workers, but much more remains to be done. A recreation area will be equipped on the shore of the Caspian Sea--60 kilometers from Novyy Uzen', at the request of the oilfield workers. The place is excellent, and the work has begun. A road should be laid there; we need it like we need the air...."

...Believe it: only a little time will pass and a recreation area for Uzen' oilfield workers will rise up on the shore of the blue Caspian. Both the city and the lives of the people who have achieved labor feats will become more attractive. For the desert is being subdued in the name of the welfare of the Soviet people.

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FUELS

BUILDUP OF FACILITIES FOR GOBUSTAN OILFIELDS IS SLOW

Baku VYSHKA in Russian 25 Nov 81 p 2

[Article by drillers A. Gasanov and B. Gadzhiyev and electrical repairman T. Dzhafarov of the Gobustan URB [Exploratory Drilling Administration] (VYSHKA's rabkor post): "The Drilling Operations Front Is Being Expanded"]

> [Text] VYSHKA has created at the Zardob exploration region a rabkor [workers' correspondent] post that will keep the progress of operations at this promising oil-bearing area under observation. Today the post's first report is published.

As is known, industrial crude oil was obtained in July this year from two holes drilled in the Zardob area. The discovery of an oilfield in this part of Azerbaijan has stimulated among Gobustan URB brigades enthusiasm and a striving to do more shockwork and to drill holes as quickly as possible.

In the competition that is being promoted for high penetrating speed, the brigade of foremen Nastretdin Bayramov and Abdulagi Samedov have achieved great success. They fulfilled the task for 1981 back in September. The drilling of hole No 9, the second in succession in the Zardob area, is going on well ahead of schedule.

Work is also progressing successfully in the brigade of the discoverer of the field, Agigat Aliyev and Sayad Mamedov. The experience that has been gained will help them to penetrate a new well, No 8, successfully. The brigade's task for the first 9 months of the year has been met 110.6 percent.

Still another brigade was redeployed not so long ago. Foremen Geydar Garayev and Sabir Aliyev are in charge of it, and they have been entrusted with sinking well No 6 to its designed depth of 4,800 meters. The drillers are working thoughtfully and purposefully, and they are trying not to lag behind the socialist competition leaders.

However, it would be incorrect to think that everything is going smoothly for us, that there are no difficulties of any kind. With the startup into operation of a third drill rig, interruptions have begun to appear in the electric-supply system. It turns out that the existing substation at Zardob is low in capacity and cannot provide for the rhythmic operation of three or more rigs. Because of the overload, the electric power is switched off, first to one and then to another rig. And this puts the penetrators of the earth's depths in a difficult situation.

The construction of a second substation--an additional one--and of power lines is being performed slowly. The collective of the Specialized Construction and Installing Administration of Azneftestroy [Trust for the Construction of Oilfield Facilities in Azerbaijan] had promised to turn the facility over prior to 15 November, but it did not keep its word.

We are also disturbed by the fact that not all drill rigs have been provided with clean service water. Take, for example, drill rig No 8, which is located some distance from the city. The waterline has not been run there, and so the drillers are using water from a nearby canal. But this water, as experience has indicated, is not suitable in composition for use in preparing clayey drilling muds. Despite the fact that the brigade expends a large amount of expensive chemical reactants, it is still not possible to achieve the required parameters. And with such a flushing liquid, it is not easy to support penetration of well bores at high speeds.

In this connection, I would like to express a reproof against the client--the NGDU [Oil and Gas Recovery Administration] of the Muradkhanlyneft' Association, which still is not paying enough attention to building up facilities for the new and promising area, where a broad front for prospecting and exploration is being developed.

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FUELS

GYURZUNDAG OIL-EXPLORATION AREA BADLY NEEDS ROADS, CLEAN WATER

Baku VYSHKA in Russian 25 Nov 81 p 2

[Article by V. Gol'tsev (Anstafa-Gyurzundag): "The Area Is New, the Problems Are Old"]

[Text] I spoke to the chief of the third Regional Industrial-Engineering Service of the Gobustan URB [Exploratory Drilling Administration] Asker Askerov about my desire to visit the new Gyurzundag area. Taking a deep breath, he asked the garage to assign a vehicle with which one could get to the drill site safely.

"The site is far," he explains. "And the garage allocates the best-kept vehicles to go there. Off the road there is only trouble."

Gyurzundag is located 40-45 km to the southeast of the Sazhdag area. This is in a straight line if, let's say, one flies from Poylu settlement by helicopter. But air transport services to the exploration site are not being used: the weather in these districts is not always summery by far. Motor vehicles are more reliable. They haul rotating-duty workers and the necessary materials and equipment to the distant drill site. It is true, this is rather far--a little less than 100 km, since one has to go in a roundabout way, through Tauz. In the fall and winter, when the road is eroded by rain or freezes slightly, delivering drill pipe, barite and other heavy freight to the site is practically impossible. But what is there to do! The road workers from Road Construction Section No 1 of Azneftedorstroyremont [Trust for the Construction and Repair of Oil-Industry Roads in Azerbaijan] still has not put down a road to the drill site, although one was laid out back in July 1980. What's the matter?

"The design and budget-estimating documentation," states section chief Rafik Zeynalov, "was not prepared on time, and this held us back."

Only in the summer of this year did the road workers undertake to build the route. It stretches from the existing road in Sazhdag, and it should connect the two new areas of the Kura and Yur'ya interriverine region--Molladag and Gyurzundag.

The road workers are now at work on the first section. Out of 16 km, little more than 5 km have been laid down. Machinery often is idled because of breakage, and automotive transport operates in slipshod fashion.

The state of affairs in the construction of a line for service water for the Gyurzundag drill site also provokes serious anxiety on the part of the drillers. In considering the elevation, it was decided to install a pump station by the river, beyond the Tauz bridge, and to build a storage tank at the topmost point. But thereafter on the 35-km path, the water flows by itself, thanks to the natural gradient.

The management of Construction and Installing Administration No 1 of Azneftestroy [Trust for the Construction of Oil-Industry Enterprises in Azerbaijan] considers that the waterline is ready now, although there are small amounts of unfinished work. But it is precisely because of this that the water does not arrive at the drill site. At the river, instead of the designed pump station, a metal framework foundation stands which has had time to start rusting. The waterline itself has been laid across steep ravines, where it is difficult to travel in case of a break. The work at the top remains uncompleted. Here the builders hastily erected, instead of a tank, a container made of thin iron, whose strength can scarcely be counted on when the container is full of water.

The drillers got out of the difficult situation, thanks to the rain water that formed whole lakes at the Kirzanskiy depression. With the help of a high-powered unit, they are pumping it to the drill rig, and into a tank, and from there it goes to their own needs. The water is enough for several days, but there is another harm here.

"The water," says diesel operator Nikolay Mikhtiyev, "contains a large amount of mechanical impurities, which clog radiators and drains. As a result, motors overheat and go out of order prematurely. We have had two diesel 'burnouts' already this year. Added capacity for clean water has now been built at the drill site. In brief, the builders let us down badly."

And the worker is right. The same subunit of builders erected a housing complex totaling 1,300 m^2 in area at Gyurzundag, several kilometers from the drill site. A dining room, showers, and comfortable rooms for living, with all the municipal services, have been placed in spacious premises decorated with plastic material, but even here the work remains unfinished. Electricity and water have not been brought to the dormitory. The complex's grounds have not yet received civic improvements. The builders have moved to another facility, leaving behind them empty oxygen tanks, broken rock and trash.

It is difficult to say when the drillers will move to the new dormitory. They still occupy, in all, two small rooms with a kitchen, which the Gobustan UBR has rented at one of the sections of the Dzheyranchel'skiy Waterline Administration. The rooms are uncomfortable and crowded. Glass in the window frames is broken, and, in order to warm the room, the workers cover them with their blankets. There is no television and no refrigerator. Also leaving much to be desired is the organization of eating in the dining room at the drill site. Produce is delivered here intermittently, and sour cream, fermented goat's milk and pot cheese are at sale rarely.

"Prospecting and exploration in this region," says A. Askerov, "are being developed widely. Right now, for example, 20-25 kilometers from Gyurzundag, a drill rig is being erected full blast at the new Teredellyar structure. According to the

Azneft' Association schedule, this year we should get it going and bring the well face down to 1,000 meters. However, neither a road nor a waterline has been laid here yet. The lag in the buildup of oilfield facilities for the area behind the pace of exploratory drilling has already become chronic. The minister of the country's oil industry, N. A. Mal'tsev, who visited this region in the summer of this year, pointed to the need to improve the construction of roads and other facilities at oil exploration sites. Unfortunately, there has been no change for the better.

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ALTERNATIVE FUEL, ENERGY RESOURCES IN CEMA AGRICULTURE

Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA EKONOMICHESKAYA in Russian No 5, Sep-Oct 81 pp 87-101

/Article by B. Ye. Frumkin and V. V. Frolov: "Alternative Fuel and Energy Resources in Agriculture of the CEMA Countries"/

/Text/ The state of the power-worker ratio in agriculture of the European CEMA countries and the possible means of increasing it by the extensive use of alternative fuel and energy resources are examined in the article. Data on the perspective scale of their use in the agrarian sphere and on the possibilities of cooperation in the development of the necessary flow charts, designs and equipment are cited.

The supply of fuel and energy resources is acting more and more in the socialist countries as one of the decisive factors of their economic growth and the increase of the well-being of the people. In the next two decades, to ensure the economic development of the countries of the community it is proposed to increase the consumption of energy carriers by 50-70 percent. The satisfaction of the increasing needs is possible only on the basis of the rationalization of the use of traditional energy resources with the simultaneous rapid increase of the consumption of alternative types of fuel and energy.

This, in turn, requires the pursuit of a flexible national energy policy with respect to individual sectors and spheres of the national economy subject to their specific production nature and importance for the growth of the economy as a whole.

Agriculture is one of the sectors, the stable development of which has significant socioeconomic and ecological consequences and in many ways depends on the level of supply of energy resources. As compared with the other sectors of the economy, agriculture has a definite specific nature: for a long time in the past its energy needs were met by internal resources, first of all the muscle power of people and draft animals, the use of the energy of water and the wind, the calorific value of agricultural waste and others. Subsequently, in accordance with the structure of energy consumption and the level of the power-output ratio, agriculture in the economically developed countries has come closer to the other sectors and at present uses primarily expensive types of fossil fuel (first of all the products of petroleum refining). With the intensification of agriculture the power expenditures also increase rapidly. For example, the increase of the yield of cereals from

20 to 40 quintals per hectare is accompanied by a 10-fold increase of the expenditures of the energy of fossil fuel.

The aggravation of the fuel and energy problem gave rise in the majority of countries of the world, including the CEMA countries, to an interest in the more extensive use of the internal resources of agriculture for meeting its own energy needs and, perhaps, in the future for the partial meeting of the needs of other sectors.[1] At present the questions of the power supply of the process of agricultural production are becoming a necessary component of the elaboration of the national and international policy of the development of the agrarian sector in the countries of the community.

In the majority of them the reserves of traditional fossil energy carriers are small, while in some (Cuba, Hungary, Bulgaria) up to 50 percent of the energy needs are met by imports. A number of CEMA countries have to pay for a certain portion of these imports with exports of agricultural products, and the effectiveness of such payments in recent years has been declining.[2] At the same time many countries have developed agriculture, the possibilities of which for energy self-sufficiency for the present are being inadequately utilized.

The industrialization of agricultural production, which began in the European CEMA countries and the USSR in the mid-1960's, was responsible for the substantial increase of the total energy expenditures on its output. The expenditures are formed from the energy, which is consumed in agriculture directly in the form of fuel and electric power, the energy expenditures of draft animals and people (so-called operating energy) and the energy, which is consumed in other sectors and is transferred to agriculture in the form of the energy of machines, mineral fertilizers, pesticides and mixed fodders (so-called embodied energy).

From 1960 to 1977 the total energy expenditures on the production of agricultural products on the average for the European CEMA countries and the USSR increased 3.2-fold, including embodied energy--4.1-fold and operating energy--2.4-fold /6, p 29/. In the structure of the expenditures of embodied energy the expenditures on the production of mineral fertilizers and pesticides increased especially rapidly (6.5-fold and 5-fold), in the structure of the expenditures of operating energy--the expenditures of electric power (8-fold). As a whole the proportion of the expenditures of embodied energy in the total energy expenditures of agriculture increased during this period from 47.5 to 60.5 percent (including mineral fertilizers and pesticides from 18.5 to 38 percent) with the simultaneous decrease of the proportion of the energy expenditures of draft animals and people (from 19.4 to 2.4 percent) and an increase of the proportion of electric power from 4.8 to 12.1 percent /7, p 22/. Similar trends are also beginning to form in some sectors of agriculture of Cuba and Mongolia.

The quantitative and qualitative changes in the consumption of energy resources by agriculture were accompanied during the indicated period, on the one hand, by an increase of the proportion of the sector in the consumption of energy by the economy as a whole and, on the other, by an increase of the power-output ratio of agricultural products.

These trends are most noticeable in the consumption of operating energy, first of all fuel, thermal energy and electric power. The consumption of these energy carriers increased in agriculture of the majority of European CEMA countries from the

early 1960's to the late 1970's approximately twofold more rapidly than for the national economy as a whole, while the share of this sector in the total consumption of energy resources increased from 1.5-4.0 percent to 3.5-8.0 percent (including electric power from 1-4 percent to 4-8.5 percent). Liquid fuel (diesel fuel, gasoline, fuel oil) accounts for approximately 80 percent of the expenditures of operating energy in agriculture of the CEMA countries. As a result of this the share of agriculture increased especially significantly in the consumption of this type of fuel, having amounted to 30 percent in some countries.[3]

The amount of operating energy, which is necessary for the production of a unit of national income in agriculture, in a number of CEMA countries with the highest level of development of this sector (for example, in Hungary, the GDR, the CSSR) during this period increased 3.5- to 4-fold, while the gap between industry and agriculture with respect to this indicator decreased from 11-9 times to 3-2 times /8, p 377; 9, p 2/. At present, for example, in Hungary 20-44 kg of energy carriers (in terms of petroleum) are needed to obtain 1 ton of cereals, 46-56 kg--sunflower seeds, 240-265 kg--alfalfa meal, 180-260 kg--pork, 400-600 kg--poultry meat /2, p 17/. Approximately the same level of the power-output ratio of agricultural products has also formed in other countries of the community.

The indicated trends in the consumption of energy carriers should also survive in the future, since given the present technical and technological level of agriculture in the CEMA countries an increase of the expenditures of fuel and power by not less than 2 percent is required for a 1-percent increase of the output of products. Therefore, in order to achieve such an agricultural power-worker ratio, which is necessary to lend it an industrial nature, according to available estimates, its increase by the year 2000 by two- to fourfold as compared with the level of the late 1970's will be required.[4] Accordingly, the share of agriculture in the total consumption of fuel and energy in the CEMA countries might come to approximately one-fifth. Such an increase might complicate considerably the already tight fuel and energy balance of the countries of the community. The slowing of this growth will limit the possibilities of increasing agricultural production and improving the supply of the population of the CEMA countries with foodstuffs and industry of these countries with raw materials.

Consequently, the taking of special steps, which are aimed at the increase of the efficiency of the use of energy resources in agriculture and the seeking of new types of these resources, which would make it possible to increase the power-worker ratio of agriculture without the worsening of the fuel and energy balance of the economy as a whole, is necessary. At present the urgency of a comprehensive approach to the power supply of agriculture of the countries of the community is increasing. It should include, in our opinion, both steps of a strategic nature and tactical measures.

On the strategic level it is expedient to examine the questions of the amount and efficiency of the use of embodied energy. They can be solved, first, on the basis of the extensive biologization of production, which will make it possible to ensure the increase of the yield of agricultural crops and the productivity of animals and poultry, as well as to ensure the improvement of the quality of the raw materials being obtained without substantially increasing the machine and tractor fleet, the increase of the amounts of fertilizers and toxic chemicals applied, the scale of

reclamation and so forth.[5] Second, the materials-output and power-output ratio of the production of machines, equipment and chemicals for agriculture can be reduced in the corresponding sectors of machine building and the chemical industry, construction and so on. It is necessary to launch the work in these directions now, although the results will have a substantial influence on the volumes of the consumption of energy in agriculture of the CEMA countries probably no earlier than the year 2000.

On the tactical level the increase of the economy of operating energy and the use of its nontraditional sources are of particular importance. It is expedient precisely in this area, in our opinion, to focus the efforts of the CEMA countries in the immediate future. The main means of scientific and technical progress in this area have been determined. They are based on the maximum utilization of the resources available in each country and can be implemented by means of comparatively small capital investments and organizational rearrangements.

The first direction of the saving of operating energy is the decrease of its expenditures on the basis of the perfection of the structure and the improvement of the operation of the machine, tractor and vehicular fleet, the improvement of rural roads, the adoption of energy-saving technologies of soil cultivation, the improvement of the thermal conditions and insulation of barns, hothouses and other agricultural facilities, the supply of thermal engineering equipment, the increase of the reliability of rural power networks and so forth.[6]

Great possibilities exist in this area in a number of CEMA countries. For example, in the USSR, according to the estimate of P. Ya. Pirkhavka (USSR), given the considerably smaller capacities of the power equipment and the level of mechanization the consumption of fuel per hectare of plowland is twofold greater than in the developed capitalist countries. According to available estimates, the tightening up of discipline in the power service of agricultural enterprises and the proper use of the machine and tractor fleet alone can provide in the CEMA countries a 5- to 7-percent saving of diesel fuel.[7] The consumption of fuel for transporting agricultural cargo over hard-surface roads is one-fifth to one-third as much as over dirt roads. The replacement of power-driven machines by electrified machines in the case of the cleaning and grading of grain, potatoes, flax and cotton provides under the conditions of the CEMA countries a saving of adjusted expenditures of 20-25 percent, including here a significant decrease of the consumption of liquid, gaseous and solid fuel.

However, given the present methods of production the choice of a type of fuel and energy for meeting approximately 85 percent of the needs of agriculture for energy carriers is rigidly governed by the requirements of technology. Mobile processes in the case of soil cultivation and the harvesting of the crop and transportation operations can be ensured only by the use of liquid fuel; the operation of stationary equipment, lighting and illumination for production and household needs can be ensured only by the use of electric power; heating processes in the municipal and household sector can be ensured by the use of mainly solid fuel, in part by the use of fuel oil, gas and electric power.

It will not be possible to decrease significantly or to change the amount and structure of these energy expenditures without a substantial change of the technology. Therefore, under the conditions of the increasing cost of traditional types of fuel, thermal energy and electric power the CEMA countries are directing more and more

attention to the second direction of the saving of operating fuel--the replacement of traditional energy carriers, which come to agriculture from other sectors and are, as a rule, unrenewable, with alternative energy resources. These new sources of energy are created and are regularly renewed in the process of agricultural production or under the influence of the effect of natural forces (the sun, the wind, the subsurface heat of the earth), as well as during the operation of industrial and power enterprises.

The production technologies used in agriculture of the CEMA countries, as well as the comparatively low prices for traditional types of liquid, solid and gaseous fuel and electric power until the mid-1970's did not stimulate the search for alternative sources of energy resources. Moreover, various installations, which used the energy of the wind and water, the heat released by barns and so on, were eliminated at many agricultural enterprises. Therefore, in agriculture of the majority of CEMA countries the renewable energy resources of agricultural origin, solar energy, wind power, geothermal energy and power industry waste heat now account for no more than 2 percent of the consumption of energy /10, p 73/. Scientific, technical, planning and design developments on the use of alternative sources of energy resources in agriculture began to be launched in the CEMA countries only in the second half of the 1970's.

The sources in question differ in the content of energy and the possibilities of its stable and economically profitable use in agriculture. However, two important features unite them: first, unlike traditional types of energy carriers, they are available in more or less significant amounts in each country and, second, their use in addition to increasing the generation of power provides an additional ecological impact (it prevents the pollution of the environment with organic, thermal and other waste products and discharges, makes it possible to adopt waste-free technologies in agriculture and closed-loop water consumption at power plants and so on).

Energy carriers of agricultural origin are the most promising type of alternative energy resources. They include various types of biomass, which is formed as a by-product of plant growing and animal husbandry, and also as a result of the cultivation of agricultural crops and other plants expressly for conversion into energy. These resources are regularly reproduced in agriculture itself and can be collected comparatively simply in significant amounts. Their energy potential is quite high, while their use is possible at plants, which have been fitted for traditional types of fuel, by their minor improvement.

The post-harvest remnants of the main agricultural crops, manure and discharges of livestock enterprises can be used for energy purposes both directly (for example, straw, corn stalks and so forth) and by means of conversion into various types of fuel (biogas, methanol and others). The amounts of such resources in the CEMA countries are quite large. Given the present technologies of cultivating agricultural crops, the weight of the waste products of their main types (that is, straw, the stalks and cobs of corn, the anthodia of sunflowers and so on) in the countries of the community per hectare is at least equal to the weight the grain, the oil-bearing seeds and so forth proper. From 15 to 50 percent of the annually formed plant waste is used for the production needs of agriculture (for the preparation of fodders, bedding for animals, the mulching of the soil and others). The remainder is plowed under or destroyed, although it has a considerable energy potential. Thus, in Bulgaria the potential of the 680,000 tons of waste products of sunflowers,

which are not used in production, is more than 150,000 tons of conventional fuel, in Hungary the potential of the 8 million tons of waste products of grain production, which are left in the fields, is estimated at nearly 2 million tons of petroleum. The energy potential of the 100 million tons of waste products of cereal and oil-bearing crops, which are annually not used in USSR agriculture, can be estimated at 25-28 million tons of conventional fuel. The complete use of the energy potential of these waste products would make it possible to meet three-fourths of the present total energy needs of agriculture of Hungary and 15 percent of the energy needs of this sector in the USSR.[9]

As a whole with the use for energy purposes of only one-third of the waste products of plant growing of the European CEMA countries (excluding the USSR), according to our estimates, it is possible to obtain energy equivalent to 5-6 million tons of conventional fuel. At the same time it is possible to prevent the contamination of the soil with organic residues, which often promote the development of diseases and pests of agricultural crops.

The conversion of animal husbandry and poultry raising to an industrial basis was responsible in the CEMA countries for the rapid increase of the amounts of the formation of manure and discharges of livestock farms and complexes. At present up to 1 billion tons of manure are formed annually in the USSR, 150 million tons in the GDR and 100 million tons in the CSSR.[10] During the next few years the bulk of them will be concentrated at large livestock complexes, which are becoming more and more widespread in the CEMA countries.[11] The increase of the amounts and concentration of solid and liquid waste products of animal husbandry is making the most prevalent systems of their disposal and use (application to the soil without preliminary treatment) unacceptable from both an economic and an ecological standpoint.

The supply of livestock enterprises with special fermentation units makes it possible to solve the energy and ecological problems in combination, ensuring the conversion of the solid and liquid manure fractions into a valuable fuel--biogas (which is 60-70 percent methane),[12] protein fodder compound and nontoxic, storable and transportable organic fertilizer.[13]

In the European CEMA countries, as experiments attest, the equipment with fermentation units is already being repaid for the farms, at which not less than 100 large-horned cattle are kept, while for fattening enterprises for 1,000-2,000 head of livestock their use ensures a normal profitability. Practice has shown the great effectiveness of the use of such units. For example, in the CSSR the units, which process 50 tons of manure a day, provide energy which is equivalent to 290 kWh of electric power.[15] In Poland the processing of the manure from a hog farm with a capacity of 1,000 head provides in a year an amount of biogas, which is equivalent in calorific value to 20 tons of gasoline. In Poland 16 large plants for the production of biogas are being built, and the production cost of 1 m^3 of gas is only 0.6 zloty, that is, it will be less than the unit expenditures on imported natural gas. A plant for obtaining biogas for a farm for 3,200 cows is being developed. The complete conversion into biogas of the manure, which is formed at the farms of the public sector of Hungary, would make it possible to meet 16 percent of the current total needs of agriculture of the country for energy.

As a whole the complete conversion of the waste products of animal husbandry into biogas, the obtaining of which is now already profitable, in the European countries

of the community could provide energy equivalent to 3-4 million tons of conventional fuel a year.

An advantage of biogas is the fact that it can be transported through the existing network of gas pipelines, can be used at heat engineering, drying and other plants, which run on natural gas, and, if necessary, can be converted into various types of liquid fuel. However, in the CEMA countries the necessary equipment is virtually not being produced and a number of them (for example, Hungary, Poland) are forced to cooperate in this area with western firms.

In recent years a new direction of obtaining energy resources in agriculture--the special cultivation of plants of high energy value--has formed in a number of countries of the world. First of all there is the cultivation of a number of agricultural crops (sugar cane and beets, manioc and other tubers, sunflowers, feed grasses and so on) for the obtaining from them of ethanol and methanol, which are used as additives to the liquid fuel which is used in agriculture and other sectors.[15] The use of these mixtures provides a combined energy-ecological impact, simultaneously decreasing the needs for gasoline for motor transport and reducing the pollution of the environment with exhaust gases.

In the CEMA countries the production of liquid fuel from sugar cane is possible in practice only in Cuba and Vietnam. Therefore, the conversion into ethanol and methanol of the basic agricultural crops of the temperate zone (for example, sugar beets) or special herbaceous and ligneous plants is of great interest. The corresponding plans are being advanced in a number of countries of Europe.[16]

According to the estimate of specialists of Yugoslavia, on the basis of the changeover of all the passenger cars in the country to a fuel mixture containing 20 percent alcohol made from sugar beets and molasses, it is possible to save 1 million tons of petroleum a year. The GDR and the CSSR could obtain approximately the same saving by the addition of alcohol to motor fuel. On the condition of the use of specially purified gasoline the addition to it of 20 percent methanol would not require the conversion of the automotive engines used in the CEMA countries.

Plans of cultivating for energy purposes plants which are not used in agriculture are being advanced in a number of countries. For example, in the United States a plan has been elaborated to establish by the late 1990's near the Pacific coast "sea farms" with an area of about 40,000 hectares for the cultivation of seaweed for the purpose of its conversion into methane.[17] In the future such farms could be established along the coast of Cuba and Vietnam.

The possibilities of cultivating plants of the class "euphorbia," the juice of which contains hydrocarbons similar to petroleum hydrocarbons, are being studied in a number of countries. The possibilities of using for energy purposes a widespread weed--spurge, which has similar properties--are being studied in the USSR.[18] It is possible to use the hydrocarbon raw materials obtained from plants as a fuel at electric power stations or to convert it into methanol for use in the chemical industry and transport. According to some estimates, hydrocarbon fuel of plant origin may cost one-half as much or less than petroleum fuel /3, p 125/.

A new sector of agriculture: the production of energy timber on special plantations, is beginning to be developed in primarily the northern capitalist countries (Norway, Finland, Sweden, Canada). This is half as expensive as the traditional

procurement for these purposes of scrap wood and noncommercial timber. Types of plants, which yield fast-growing energy timber (various species of willow, osier, popular), have already been bred, the technology and equipment of their cultivation and conversion into wood briquets, which in calorific value are not inferior to coal briquets, into a powder for use as boiler fuel and into methanol for adding to liquid fuel have been developed. According to the estimate of Finnish scientists, by 2000 Finland will have 550,000 hectares of willow plantings, the output of which will make it possible to save about 2 million tons of petroleum a year. The use for energy plantations of all the land unsuitable for conducting agriculture (swamps, peat bogs, rocky sections) in Norway and Sweden would make it possible to obtain an amount of wood, which is sufficient to meet half of the needs of these countries for petroleum.

Similar plans could be implemented in some regions of the CEMA countries (for example, in the alpine and piedmont areas of Poland, Romania and the CSSR, in a number of regions of the USSR, in the Danube River regions of Bulgaria and Romania). Plants for the conversion of fast-growing species of tropical plants into fuel could be developed for Cuba and Vietnam.[19]

As a whole the cultivation of special plants would enable the European CEMA countries in the 1990's to obtain an additional 1-2 million tons of conventional fuel.

With allowance made for timber resources, on the basis of the improvement of the gathering and conversion for energy purposes of the waste products of plant growing and animal husbandry the European CEMA countries in the future (in the 1990's) could annually obtain energy equivalent to 10-13 million tons of conventional fuel.

The use of natural energy (solar, wind, geothermal), as well as the waste and low-potential heat from industrial and power enterprises is the second major reserve of the increase of the power supply of agriculture. The merit of these types of energy is the relative inexpensiveness of their assimilation and use, the shortcoming is the territorially limited group of users, which includes nearby enterprises, and, in a number of cases, the inadequate stability of the power supply.

The use of solar energy, which, in spite of its low intensity, is economically efficient to 56° N, that is, on practically the entire territory of the European CEMA countries for 180 days a year (from April to October), is the most practicable. According to available estimates, from 1 m^2 of solar arrays on the average in the northern group of CEMA countries it is possible to obtain energy equivalent to 2-2.5 kWh of electric power a day, while in the southern group--up to 3.5 kWh.[20]

Studies on the development of thermodynamic solar electric power stations (a portion of the power of which will also be used in agriculture), water-lifting and other solar stations are being carried out in a number of CEMA countries with allowance made for the available reserves of solar radiation.[21] However, special studies on the use of solar energy in agriculture are being conducted on a limited scale. In the majority of CEMA countries the production of the solar power units suitable for this sector has not been set up, economical designs of heat, water-lifting and other units have not been developed. The solar power plants, which have been built by the forces of individual agricultural enterprises and scientific institutions, for example, in the USSR, the CSSR and Romania, are used mainly for the heating of water for the needs of animal husbandry.[22] They are of low capacity and are relatively expensive.

At the same time practice shows that the use of such plants in regions with high solar radiation can be very efficient. The construction of 675,000 m^2 of solar arrays, which generate power equivalent to 175,000 tons of conventional fuel, is envisaged in the CSSR by 1990. The construction of solar thermoelectric and photoelectric power plants is also planned in a number of other European CEMA countries (for example, Bulgaria, Hungary, Romania, the USSR). Given the present methods of converting solar energy into thermal energy and electric power, it is possible to expect the receipt from these plants in the 1990's of energy equivalent to 0.6-1.1 million tons of conventional fuel. Taking into account that the needs of agriculture, especially in desert and mountainous regions, can be met by means of comparatively small and inexpensive plants, the design of which has already been developed, at least 0.3-0.6 million tons of conventional fuel of this energy could be used in it. A major program on the development of solar power engineering, first of all for the needs of nomadic animal husbandry and hothouse vegetable growing, is being implemented in Mongolia, on half of the territory of which the use of solar energy is efficient.

The CEMA countries have considerable wind power resources. The use of windmills pays for itself with an average annual wind velocity of 5 m/sec, while the optimum conditions for their operation are created with a velocity of 7-10 m/sec. According to the data of P. Bagudin, such conditions exist, in particular, in the coastal regions of Bulgaria, the GDR, Poland and Romania. In 65 regions of the USSR the wind velocity achieves 6 m/sec. During 1973-1975 wind-powered pump and generating units were installed at the kolkhozes and sovkhozes of a number of regions of the USSR. In spite of the design flaws, they operated quite efficiently[23] and ensured the service of some rural territories for 300 days a year. At present the designs of windmills with a capacity of 4 to 100 kW are being developed in the USSR.[24] Their power is sufficient for the economical servicing of the pumping stations in pastures, in irrigation and draining systems, for the supply of electric power to rural settlements of average size, the heating of water for the needs of large livestock farms and so on.

Extensive opportunities for the use of windmills exist in the majority of European CEMA countries, in Cuba and Vietnam. It is especially efficient under the condition of Mongolia, where the creation of a branched network of rural power networks is impossible, while the supply of the pasture corrals of livestock breeders with solid and liquid fuel requires great expenditures. The operation of windmills is possible on half the territory of Mongolia. According to some estimates, it is possible in the near future to increase the total capacity of the windmills in the USSR to 800,000-850,000 kW, which will make it possible to save 1.5-2 million tons of conventional fuel. With the construction of combined wind-powered and pumped storage stations this saving might increase by three- to fourfold /4/. Since agriculture of the CEMA countries is one of the most promising sectors for the development of wind power technology, it is possible to anticipate that in the 1990's it will save by the use of the energy of the wind 1-1.5 million tons of conventional fuel.

In a number of regions of the CEMA countries the great potentials for meeting the needs of agriculture for energy are connected with the use of the subsurface heat of the earth, first of all geothermal waters. In the USSR the reserves of geothermal heat are estimated at 50 million tons of conventional fuel, in the CSSR--3 million tons of conventional fuel. In Hungary the geothermal reserves of energy exceed the total energy value of all the reserves of coal, petroleum and gas in the

country. In agriculture of Bulgaria, Hungary, the USSR and the CSSR geothermal waters are used mainly for the heating of hothouses and the central heating of livestock farms. Given the prevailing technologies, the scale of this use is limited, since high-temperature, but low-mineralized waters are required for agricultural purposes.[25] Therefore in Bulgaria for the present only 6 percent of the thermal waters are used in hothouse production, in Hungary (in various sectors of agriculture) 7 percent and so on.[26]

In Hungary 4-6 percent of the area of hothouses under polymeric film is heated by thermal waters. In the future this proportion will increase.[27]

A plan of the use up to 1990 of geothermal waters by the five main consuming sectors, including agriculture, has been adopted in Hungary. In Bulgaria the program of the construction of hothouses on the basis of geothermal sources should provide by 1985 a saving of 35,000-40,000 tons of liquid fuel per heating season.

The designing and construction of hothouse combines with geothermal heat supply with a total area of about 200 hectares are being carried out in the USSR. Their placement into operation will make it possible to save from 500 million m^3 to 1.5 billion m^3 of natural gas a year (0.5-1.5 million tons of conventional fuel). After the development of the heat engineering equipment, which makes it possible to use highly mineralized and corrosive thermal waters, the area of such hothouses can be increased to 500 hectares, while the saving of gas can be doubled. The development of equipment for the use of medium-temperature geothermal waters will make it possible to increase these hothouse areas in the USSR to 1,000 hectares /5, p 20/. Other means of using geothermal waters, particularly for heating the soil, are also being developed.[28]

As a whole the maximum use of geothermal water supply in agriculture of the European CEMA countries could provide energy which is equivalent to 2.0-2.5 million tons of conventional fuel a year. The realization of this potential depends on the supply of the necessary equipment, which is almost not being produced in the countries of the community.

The low-potential heat of industrial enterprises, thermal and nuclear electric power stations and main gas pipelines is an important source of the power supply of agriculture. The exhaust heat of industrial and power plants is estimated at present in the USSR at 100 million tons of conventional fuel, in the GDR--12 million tons, in Poland--7 million tons and in the CSSR--4 million tons. In the next decade, as the specialists of these countries believe, the amount of this resource will double. At the same time, 60 percent of the exhaust heat of industrial plants can be reused in technological processes. Many enterprises of the CEMA countries have already been fitted with the appropriate equipment. In this connection this type of heat can be used in agriculture on a limited scale, for example, at plant subsidiary farms (hothouses, fattening farms and so forth),[29] first of all in regions with insufficiently developed agricultural production.

The prospects of the agricultural use of the heat of gas compressor stations of main gas pipelines are more favorable. As the studies conducted in CEMA countries showed, it is most prefereable to direct it for the heating of hothouses and warehouses, poultry factories and others, the drying of grain and potatoes and the preparation of fodders. According to some estimates, this can provide a saving of fuel of 10 to 50 percent. In the CSSR a special law has been passed, which calls

for the obligatory use of the waste heat from the transit gas pipeline in agriculture. The construction of 80 hectares of glass hothouses and 10 hectares of film hothouses, 15 grain dryers and 2 warehouses with an artificial climate is planned on this basis in the country before 1985. This will make it possible to use 7.5 percent of the energy of waste heat, to obtain an additional 8,000-10,000 tons of early vegetables and to save about 200,000 tons of conventional fuel in the form of fuel oil or natural gas. The use of the waste heat of the gas pipeline for heating the soil in hothouses, in the opinion of some Czechoslovak economists, is even more efficient. In this case the possible degree of its use increases to 75 percent, while the area of hothouses increases to 750 hectares. In the USSR on this basis, according to the estimate of L. Pozdnyakov, it is possible to carry out the heat supply of hothouses with a total area of about 400 hectares. The inadequate production of fittings for heating stations, heat exchangers and automatic equipment for temperature regulation serves as an obstacle. For the present in the USSR only a few hectares of such hothouses are being used. In the future it is planned to build subsidiary agricultural installations at all the large gas compressor stations in the USSR, especially in the regions of new development.

A portion of the waste heat of main gas pipelines can be used for the generation of electric power with its subsequent use in agriculture. Thus, a unit developed in the CSSR for the conversion of thermal energy into electric power makes it possible in a year to obtain, given the present capacity of the gas pipeline, 61 million kWh of electric power, that is, 2 percent of the electric power now being consumed in agriculture of the CSSR.[31]

The use of the waste heat of thermal and nuclear electric power stations is also very promising. Along with a large economy of energy expenditures in agriculture this makes it possible to prevent the pollution of the environment with waste heat without the construction of expensive cooling systems, to ensure closed-circuit water use at these electric power stations and others. The reserves of waste heat energy of thermal and nuclear electric power stations in the CEMA countries are quite significant. In Hungary, for example, they are now equivalent to 1 million tons of petroleum.

These wastes can be used for the heating of hothouses and barns, the irrigation and heating of soil with thermal waters, the creation of thermal fish ponds and various combinations of these facilities. Thus, in the CSSR a design has been developed, in accordance with which the waste heat of one block of the nuclear electric power station with a capacity of 440,000 kW will ensure the heating of hothouses with an area of 16 hectares. With such use of waste heat it is possible to obtain an additional 15,000-20,000 tons of early vegetables. In the USSR, according to the estimate of L. Pozdnyakov, the use of the heat of nuclear electric power stations and nuclear boiler houses will make it possible to carry out the central heating of hothouses with an area of about 650 hectares. The program of the designing and construction of hothouses with an area of 450 hectares is already being carried out. It will make it possible to save annually about 2-2.3 million tons of conventional fuel. The use of the waste heat of thermal electric power stations and nuclear electric power stations can also provide a significant economic impact in commercial fish breeding.[32]

The combined use of the waste heat of nuclear electric power stations is also envisaged in the CEMA countries. For example, at the nuclear electric power station in Northern Moravia (the CSSR) it is planned to build an agricultural complex which

includes hothouses, a soil heating system, intensive gardens with an antifrost system, a hog farm for 30,000 head, a poultry factory for 1.5 million head, refrigerators, fish ponds and a number of other facilities.

The involvement of the examined types of energy in the fuel and power balance of agriculture requires certain capital investments. However, as the calculations of specialists of the CEMA countries show, with a payback period of 7-12 years they are comparable to or less than the capital investments necessary for the implementation of programs of the saving of traditional energy resources in agriculture, as well as for the increase of the production of fossil fuel or the payment for the increase of its imports. In the CSSR, for example, the costs for obtaining 1,000 kW of energy by the conversion of the waste heat of the transit gas pipeline come to 5,300 korunas, which is half as much as the production cost of electric power generated at coal-burning electric power stations of the country, while the price of 1 gigacalorie of waste heat used in agriculture (17-27 korunas) is one-tenth of the cost of the heat generated by the traditional method. The expenditures on the building of 1 m^2 of collectors of solar arrays (including all the appropriate equipment) in the CSSR come to 2,500-3,000 korunas and will pay for themselves in 7-13 years.[33] The capital investments in the construction of hothouse complexes on the basis of thermal waters under the conditions of Bulgaria will pay for themselves in 6-7 years, which is considered quite effective in connection with the increase of the prices for liquid fuel.

According to the estimates of Hungarian specialists, the expenditures when using geothermal waters for the warming of water and the heating of barns are 50-70 percent less than when using conventional types of energy. The expenditures on the furnishing of the energy of geothermal waters for the heating of hothouses are 80 percent less than on the transportation of liquid or gaseous fuel.

Large state farms and cooperatives can make these expenditures by means of their own assets. In necessary instances interfarm associations for the use of solar energy, wind power and geothermal energy can be set up. Enterprises for the conversion of the waste products of plant growing and animal husbandry for energy purposes can also be set up on an interfarm basis.

The use of the waste heat of industrial and power installations requires large one-time outlays, and, although the capital investments pay for themselves in 4-5 years, they are beyond the power of agricultural enterprises and even their associations. For example, according to the estimates of scientists of the CSSR, the additional expenditures on the agricultural use of the waste heat of one block of a nuclear electric power stations with a capacity of 440,000 kW come to 8 billion korunas, which is approximately equal to 40 percent of the average annual capital investments in agriculture of the country. At the same time the expenditures on the creation of an agricultural complex at the nuclear electric power station in Northern Moravia will come to 20 percent of the expenditures on the construction of the station, which is less than the expenditures on the building of special cooling systems. Consequently, such capital investments are effective not only for agriculture, but also for power engineering and industry. It is expedient to make them at the expense of the assets allocated by industrial enterprises for the creation of subsidiary farms or by the pooling of the assets of the state organs which are in charge of agriculture and power engineering.

In recent years the questions of the use of alternative energy resources in agriculture have occupied a greater and greater place in the agrarian policy of CEMA countries, for example, Bulgaria, Hungary, the GDR and Romania. In the CSSR by 1990 it is proposed to meet 10 percent of the needs of the sector for energy by means of such energy resources. The Basic Directions of USSR Economic and Social Development for 1981-1985 and the Period to 1990 envisage the increase of the use of these resources in agriculture, first of all in hothouse production and fish breeding /1/. In the future the steps on alternative energy supply will turn into an obligatory component of the development of national agro-industrial complexes.

At the same time these questions cannot be solved only within the agro-industrial complex, since the power sectors proper and the sectors of power machine building do not belong to it. The coordination of the technological policy of three large complexes (agro-industrial, fuel and power and machine building) and the appropriate coordination of the programs of their development in each country are necessary for the large-scale and efficient use of alternative energy resources in agriculture. So far the lack of such coordination has limited substantially the use of alternative energy resources in Bulgaria, Hungary, the USSR and other CEMA countries.

The cooperation of the CEMA countries can and should become an important factor of the intensification of the use of alternative sources of energy resources in agriculture and fish breeding. For example, the sharing of experience in questions of the replacement of high quality types of fuel with electric power in agriculture and forestry has begun in the past 2-3 years alone within the CEMA Permanent Commission for Agriculture.[34]

The scientific and technical cooperation in the use of straw and other byproducts of plant growing for obtaining thermal energy, liquid manure for obtaining biogas, geothermal energy for drying products and heating, wind power and solar energy has been limited, for the most part, to the exchange of information.

The Coordinating Center for the development of new efficient methods of the conversion of solar, chemical and geothermal energy and wind power into electric power and thermal and mechanical energy and the development on this basis of economical devices and units has been operating within CEMA since 1978. However, the specific nature of agriculture is not being taken completely enough into account in the work of the center. Multilateral production and economic cooperation on the use of alternative energy resources in agriculture has not been set up. The bilateral scientific, technical, production and trade relations of the CEMA countries in this area so far are also poorly developed.

In the future these questions should be solved in combination, having included the corresponding measures in the multilateral long-term goal programs of cooperation on energy, fuel and raw materials, on agriculture and the food industry, as well as bilateral programs of the specialization and cooperation of the CEMA countries. These measures can cover the development of technologies of the use of alternative sources of energy resources in agriculture, the determination of the technical and economic parameters of the corresponding equipment and the identification of the need for it and so on. Plans of subsidiary agricultural complexes for power facilities which are being built jointly, as well as plans of power plants using alternative energy resources for the programs being implemented jointly in agriculture and the food industry (for example, at the sugar and citrus agricultural complexes of Cuba, the fodder and livestock complex in Mongolia) should be drawn up. Cooperation

in the development and production (on the basis of specialization and cooperation) of the necessary equipment could be envisaged in the machine building long-term goal program of cooperation.

For the intensification of scientific and technical ties it is expedient to take into account to a greater extent the needs of agriculture for a coordinating center for the development of new methods of converting energy or to set up a special coordinating center for questions of the use of alternative energy resources in agriculture. In the future it can be turned into an international nongovernmental organization for nontraditional sources of energy for agriculture.

The problem of the use of alternative fuel and energy resources in agriculture by its nature and potential results is an intersectorial problem, it involves a number of large national economic complexes, first of all the fuel and power complex and the agro-industrial complex. The methods of solving this problem also can be only comprehensive methods which require the involvement of the sectors of both these structures. At the same time the coordination of the national and collective efforts of the CEMA countries in this area can make a significant contribution to the balanced solution of the key socioeconomic problems of the community--the energy, food and ecological problems.

FOOTNOTES

1. According to an estimate of the FAO by 2000 by means of the use of these resources it would be possible to meet 10 percent of the needs of European agriculture for energy.

2. Thus, as compared with the early 1970's the prices for petroleum on the world markets have increased more than 10-fold, while t' prices for agricultural products have increased only 2-fold. The amount o. petroleum, which can be purchased for 1 ton of grain, has decreased during these years to one-fourth to one-fifth.

3. In Bulgarian agriculture during 1971-1975 approximately 8 million tons of gasoline and diesel fuel were consumed, while in Hungary in 1978 the consumption of fuel oil and diesel fuel in the sector exceeded 1.4 million tons.

4. The energy expenditures at modern livestock and hothouse complexes are especially large. Thus, the Yuzhnyy Hothouse Combine with an area of 108 hectares of enclosed ground, which is being built in the Northern Caucasus, has a boiler house which is sufficient for heating a city with a population of 400,000, a special gas pipeline and electric power transmission line have been laid to it.

5. According to the estimate of Hungarian scientists, by means of controlled breeding it is possible to reduce the present need of plant growing for mineral fertilizers by 10-20 percent.

6. Proposals on the stabilization and even the expansion of the use of live draft power in agriculture of the CEMA countries are being advanced. At a number of agricultural enterprises of the USSR it is considered expedient to use horses extensively for hauling small loads, for tilling small plots of land and so

forth. This makes it possible to release tractors and motor vehicles for more major operations and to save considerable assets, including for fuel. Horses are employed at the farm 250-260 days a year, while the expenditures per horse-day are 1.2 rubles as against 25 rubles per tractor-day.

7. In Hungary by means of the thrifty use of fuel and lubricants and the dissemination of efficient methods of managing the farm (the tilling of land with lightweight plows, the storage of corn without drying and others) during 1978-1980 the consumption of liquid fuel in agriculture decreased by 10 percent with an increase of the output of the agrarian sector by 20 percent.

8. Thus, in the United States the postharvest remnants of agricultural crops and the waste products of animal husbandry contain more energy than American agriculture now consumes. In Hungary the energy contained in the byproducts and waste products of agriculture is equivalent to 95 percent of the present total energy needs of the sector.

9. In the main grain region of Yugoslavia (Vojvodina) it is proposed to meet about half of the energy needs of agriculture by means of the waste products of plant growing.

10. French specialists believe that in energy value 100 million tons of manure are equivalent to 1.5 million tons of petroleum. In Austria it is proposed to meet about 5 percent of the total consumption of energy by means of biogas.

11. Thus, in the USSR in 1978 166 hog complexes with a capacity of 24,000 to 108,000 head were in operation; similar complexes with a capacity of 10,000 to 100,000 head are being built in the GDR, Poland and the CSSR.

12. According to the data of P. Bagudin (USSR), the calorific value of biogas is 5,000-7,000 kilocalories/m^3, while after the removal of carbon dioxide from it, it is 8,000 kilocalories/m^3.

13. The use of this fertilizer makes it possible to increase the yield of agriculture crops by 15-20 percent.

14. The productivity of the plant for the conversion of manure at the hog raising farm in the region of Trsebon (CSSR) is 3,000-4,000 m^3 of biogas a day.

15. In Brazil in 1978 such fuel mixtures were used in 15 percent of the motor vehicles, by 1985 this proportion will come to 45 percent. In the United States in 1979 their use came to 300,000-380,000 liters.

16. Thus, in France it is proposed to allot 30,000 hectares of planting of sugar beets for their conversion into natural ethanol, which will make it possible to give up the importing of petroleum, which is used for obtaining synthetic ethanol (120,000 tons a year).

17. It is believed that it is possible to obtain from 1,000 hectares of seaweed methane which is equivalent in calorific value to 10,000 tons of petroleum a year.

18. According to the estimates of U.S. scientists, it is possible to obtain from 1 hectare of plantings of spurge from 4,000 to 20,000 liters of juice a year.

19. Such plants are already being designed in France for Latin American countries.

20. This is enough to heat 40-50 liters of water to a temperature of 40-50° C.

21. For example, solar power plants for supplying hot water and drying agricultural products are in operation in the USSR. Photoelectric water-lifting plants have been installed in three cities.

22. In the CSSR such plants are found at 200 of the 1,747 cooperatives.

23. A wind-powered pumping station with a capacity of 1-2 kW daily provides water to 2,000 sheep or 300 cows. Under the conditions of the steppe regions of the USSR such stations save annually up to 1,500 tons of gasoline and pay for themselves in 2 years.

24. Windmills with a capacity of 18-30 kW, which operate in combination with a diesel generator, make it possible to save up to 75 percent of the diesel fuel.

25. In the USSR, for example, only about 3 percent of the reserves of geothermal waters meet these conditions.

26. Nevertheless Hungary holds one of the leading places in the world in their agricultural use. Of the 545 geothermal sources active in Hungary, 80 are used for heating hothouses with a total area of 170 hectares and 30 livestock farms.

27. A new type of hothouse with a geothermal water screen, in which the expenditures on the heating of 1 m^2 come to only 4 percent of the expenditures at hothouses running on fuel oil, in particular, has been developed.

28. In the USSR, for example, a unit has been developed for heating fruit trees in winter with geothermal waters.

29. Nevertheless, experience in the efficient agricultural use of this heat exists in a number of CEMA countries (the GDR, the USSR, the CSSR). Thus, in the region of Merseburg (GDR) hotbeds with an area of 4.5 hectares operate on the basis of the waste heat from a local chemical plant.

30. Thus, according to the estimate of V. Boyev (USSR), the inexpensive waste heat of industrial enterprises in the zone of the Baykal-Amur Railway Line will make it possible to set up an efficient hothouse system, which exceeds the average union level in the production of output per resident.

31. With the increase of the transit deliveries of Soviet gas by 1990 the generation of electric power could reach in the CSSR 150-200 million kWh a year.

32. In the CSSR at experimental ponds with the heating of the water to 43° they obtained from 1 hectare of surface of the pond up to 30 tons of fish, while in the control ponds they obtained not more than 1.5 tons. According to the estimates of specialists of the USSR, the productivity of a unit of area of the

fish ponds in the cooling ponds of thermal electric power stations is 1,500-fold greater than in conventional ponds.

33. Thus, the expenditures on the construction of 70 m^2 of solar arrays at one of the cooperatives of the CSSR were 120,000 korunas.

34. In this connection the agrotechnical requirements for electric- and heat-retaining dryers for grain, tobacco and others are being elaborated.

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